What is claimed is:

1. Method for making a web of paper or board, the method comprising the steps of:

- forming a web (11) from fibers, and

- treating the web (11) with pigment particles,

c h a r a c t e r i z e d in that the web is treated with particles having an average size in the range of 0.5 - 100 nm, most advantageously 15 - 25 nm.

2. Method according to the claim 1, c h a r a c t e r - i z e d in that, that the web is treated with such elementary pigment particles that have an average size sufficiently small to bind the particles together at least by van der Waals forces.

3. Method according to claim 1, c h a r a c t e r - i z e d in that the web is treated with calcium carbonate particles ($CaCO_3$).

4. Method according to claim 3, c h a r a c t e r - i z e d in that the web is treated with particles comprised essentially of single elementary particles.

5. Method according to claim 3, c h a r a c t e r - i z e d in that the web is treated with flocced particles comprised of elementary particles.

6. Method according to claim 1, c h a r a c t e r - i z e d in that the web is treated with flocced particles having an average size not larger than 500 nm.

7. Method according to claim 5 or 6, c h a r a c - t e r i z e d in that the size of the flocced particles

comprised of the elementary particles is controlled by arranging turbulent conditions for the particle flow and then controlling the degree of turbulence in the flow.

8. Method according to claim 5 or 6, c h a r a c t e r i z e d in that the size of the flocced particles comprised of the elementary particles is controlled by adjusting the pH level of the particle surroundings.

9. Method according to claim 1, c h a r a c t e r i z e d in that the particles are formed on the web surface by first treating the web with slaked lime (CaO), then reacting the slaked lime with water in order to form calcium hydroxide ($Ca(OH)_2$) and finally reacting the calcium hydroxide with carbon dioxide (CO_2) in order to form calcium carbonate particles ($CaCO_3$).

10. Method according to claim 1, c h a r a c t e r i z e d in that the particles are formed on the web surface by first treating the web with calcium hydroxide ($Ca(OH)_2$) and then reacting the calcium hydroxide with carbon dioxide (CO_2) in order to form calcium carbonate particles ($CaCO_3$).

11. Method according to any of foregoing claims 1 - 8, c h a r a c t e r i z e d in that the solids content of the web treatment material is at least 80 %.

12. Method according to any of foregoing claims 1 - 8, c h a r a c t e r i z e d in that the particles of the web treatment material are adhered to the web surface and the web is treated prior to the application of the particles by alum, polymer, electrolytic or corona discharge treatments.

13. Method according to any of foregoing claims 1 - 8, c h a r a c t e r i z e d in that the adherence of the

particles of the web treatment material to the web surface is augmented after the application step by electromagnetic radiation treatment using, e.g., infrared, ultraviolet, radioactive, x-ray or microwave radiation.

14. Method according to any of foregoing claims 1 - 8, c h a r a c t e r i z e d in that the adherence of the particles of the web treatment material to the web surface is augmented by mechanical or thermomechanical treatment.

15. Method according to claim 14, c h a r a c t e r - i z e d in that the web (11) is brushed in order to elevate microfibrils (30) of the web fiber walls up from the web surface.

16. Method according to claim 15, c h a r a c t e r - i z e d in that the brush material is selected so that the surface of the web (11) is charged with static electricity of negative or positive polarity as desired.

17. Method according to any of foregoing claims 1 - 8 c h a r a c t e r i z e d in that the web is calendered after the particle treatment step.

18. Method according to claim 17, c h a r a c t e r - i z e d in that the web is calendered prior to the crystallization of the calcium carbonate particles from their amorphous state.

19. Method according to claim 18, c h a r a c t e r - i z e d in that at least one of the calender rolls (27, 28) is a hot roll.

20. Method according to claim 18, c h a r a c t e r - i z e d in that the web (11) is treated with a treatment material prior to calendering.

21. Method for forming a web of paper or board or any other chiefly plant-fiber-based web, said method comprising the steps of

- spreading on a moving web-formation substrate (1) such web-forming raw material that contains cellulosic fiber, plant fiber or other material suitable for manufacturing a paper, board or nonwoven product.

- feeding the raw material on said web-formation substrate (1) and travelling thereon into at least one compressive nip (1, 5, 11, 12) in order to form a firm web from the fibers of said raw material,

c h a r a c t e r i z e d in that

- bringing said web-formation substrate (1) to a first electrical potential,

- applying a second potential higher than said first potential and displaced from said first potential at distance above that side of the web-formation substrate (1) on which the raw material furnish is being fed, whereby an electric field is established between said potentials,

- adjusting the voltage between said first potential and said second higher potential so high as to establish a corona discharge in the vicinity of a point brought to said second higher potential, said discharge being capable of causing an ion blast from said higher potential to said lower potential, whereby said ion blast transports the particulate raw material existing in the space between said potentials onto said web-formation substrate (1) and assures the adherence of the raw material to the

substrate (1), and

- treating the web with elementary pigment particles having an average size in the range of 0.5 - 100 nm, most advantageously 15 - 25 nm.

22. Method according to claim 21, characterized in that the treatment material particles are added to the web at least during the web formation step, whereby the particles form interfiber bonds at least by van der Waals forces.

23. Method according to claim 21 or 22, characterized in that the treatment material particles are added to the surface of the formed web.

24. Method according to claim 23, characterized in that the treatment material particles are added to the surface of the formed web by means of an ion-blast technique.

25. Method according to claim 21, characterized in that the web is treated by adding the particles to the web surface by first treating the web with slaked lime (CaO), then reacting the slaked lime with water in order to form calcium hydroxide ($Ca(OH)_2$) and finally reacting the calcium hydroxide with carbon dioxide (CO_2), whereby calcium carbonate particles ($CaCO_3$) are formed.

26. Method according to claim 21, characterized in that the web is treated by adding the particles to the web surface by first treating the web with calcium hydroxide ($Ca(OH)_2$) and then reacting the calcium hydroxide with carbon dioxide (CO_2), whereby calcium carbonate particles ($CaCO_3$) are formed.

27. Method according to any of foregoing claims 21 - 26, c h a r a c t e r i z e d in that the particles of the web treatment material are adhered to the web surface and the web is treated prior to the application of the particles by alum, polymer, electrolytic or corona discharge treatments.

28. Method according to any of foregoing claims 21 - 26, c h a r a c t e r i z e d in that the adherence of the particles of the web treatment material to the web surface is augmented after the application step by electromagnetic radiation treatment using, e.g., infrared, ultraviolet, radioactive, x-ray or microwave radiation.

29. Method according to any of foregoing claims 21 - 26, c h a r a c t e r i z e d in that the adherence of the particles of the web treatment material to the web surface is augmented by mechanical or thermomechanical treatment.

30. Method according to claim 29, c h a r a c t e r i z e d in that the web (11) is brushed in order to elevate microfibrils (30) of the web fiber walls up from the web surface.

31. Method according to claim 30, c h a r a c t e r i z e d in that the brush material is selected so that the surface of the web (11) is charged with static electricity of negative or positive polarity as desired.

32. Method according to any of foregoing claims 21 - 26, c h a r a c t e r i z e d in that the web is calendered after the particle treatment step.

33. Method according to claim 32, c h a r a c t e r i z e d in that the web is calendered prior to the

crystallization of the calcium carbonate particles from their amorphous state.

34. Method according to claim 33, c h a r a c t e r i z e d in that at least one of the calender rolls (27, 28) is a hot roll.

35. Method according to claim 33, c h a r a c t e r i z e d in that the web (11) is treated with a treatment material prior to calendering.

36. Method according to any of foregoing claims 21 - 26, c h a r a c t e r i z e d in that the web is treated with recycled calcium carbonate obtained from the precipitated calcium carbonate residue of the deinking process of recycled fiber.

37. Method according to claim 36, c h a r a c t e r i z e d in that the calcium carbonate is prepared by calcining calcium-carbonate-containing precipitate into lime, reacting the lime with water and reacting the calcium hydroxide thus formed with carbon dioxide in a turbulent gas phase, whereby fine particulate calcium carbonate is formed.

38. Assembly for making a web of paper or board containing calcium carbonate, the assembly comprising:

- means (12 - 15) for supporting a web (11) being formed, and

- means (1 - 7, 21 - 25) for forming calcium carbonate at least on the surface of said web (11),

c h a r a c t e r i z e d in that said means for forming calcium carbonate comprise at least:

- means (22) for feeding calcium hydroxide into contact with the surface of said web (11), and

- a chamber (22) via which said web (11) is adapted to travel and into which chamber is passed carbon dioxide containing gas in order to react carbon dioxide with calcium hydroxide so as to form calcium carbonate.

39. Assembly according to claim 38, c h a r a c t e r - i z e d in that said means for feeding calcium hydroxide into contact with the surface of said web (11) comprise at least means (1 - 7, 21 - 23) for applying slaked lime on the surface of said web (11) and means (21) for reacting said slaked lime with water in order to form calcium hydroxide.

40. Assembly according to claim 38, c h a r a c t e r - i z e d in that said means for feeding calcium hydroxide on the surface of said web (11) comprise gas-atomizing liquid jet nozzles in which calcium hydroxide solution is sprayed via the nozzle jet orifice and carbon-dioxide-containing gas is discharged via the atomizing orifices of the nozzle, whereby the reaction between said two components forms calcium carbonate.

41. Assembly according to claim 38, c h a r a c t e r - i z e d in that said means for feeding slaked lime on the surface of said web (11) comprise:

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- means (1, 2, 3, 21) for feeding mineral-based materials or other furnish required in the making of a paper or board web or a nonwoven product onto the surface of a web (11) travelling on support means,

- at least one connection (16) for applying a first electrical potential to said web-supporting means

(12 - 15) thus forming a first electrode,

- at least one second electrode (22) disposed at a distance from said web-supporting means (15) forming said first electrode, and

- a high-voltage supply (23) for elevating the voltage between said first electrode (15) and said at least one second electrode (22) so high that as to establish a corona discharge in the vicinity of said second higher-potential electrode (22), said discharge being capable of causing an ion blast from said second higher-potential electrode (22) to said first lower-potential electrode (15), whereby said ion blast transports the particulate raw material existing in the space between said potentials (15, 22) onto said web-formation substrate (11) running on said web-supporting means (15) and assures the adherence of the raw material to the substrate (11).

42. Assembly according to claim 41, c h a r a c t e r i z e d by

- an ion-blast chamber (21) via which the moving web (11) being treated is adapted to pass and into whose interior said at least on second electrode (22) is disposed, and,

- means (3) for keeping said treatment material of microscopic particles in a continuous turbulent motion at least within the interior of said ion-blast chamber.

43. Assembly for treating a paper or board web with a treatment material, said assembly comprising:

- an electrically conducting moving wire (15) having

a first surface and a second side on reverse side to said first side, said wire being adapted to support said web (11) to be treated, and

- means (1 - 7, 21 - 23) for feeding said treatment material containing mineral-based components onto said web (11) travelling on said first surface of said moving wire (15),

c h a r a c t e r i z e d by

- at least one first electrode (15) for forming a first potential field on said second side of said wire (15),

- at least one second electrode (22) disposed at a distance from the first side of said wire forming said first electrode, and

- a high-voltage supply (23) for elevating the voltage between the first electrode potential (16) and said at least one second electrode (22) so high that as to establish a corona discharge in the vicinity of said second higher-potential electrode (22), said discharge being capable of causing an ion blast from said second higher-potential electrode to said wire (15) forming said first electrode of said lower potential (16), whereby said ion blast transports the particles of said web-treatment material existing in the space between said potentials onto said web (11) and assures the adherence of the raw material to the web (11).

44. Assembly according to claim 43, c h a r a c t e r i z e d by

- an ion-blast chamber (21) via which the web (11)

being treated is adapted to pass and into whose interior said at least one second electrode (22) is disposed, and,

- means (3) for keeping said treatment material of microscopic particles in a continuous turbulent motion at least within the interior of said ion-blast chamber (21).

45. Assembly according to claim 44, c h a r a c t e r - i z e d in that said means for keeping said treatment material in a continuous turbulent motion comprise a particle circulation tube (3) adapted to perform in the ion-blast chamber as a return circulation path via which said treatment material can be fed into said ion-blast chamber (21) and via which the fraction of the material not adhering to the web can be removed and returned back to the ion-blast chamber and further serving to keep the particles of the treatment material in continuous motion so that said particles form aggregate particles of a desired size.

46. Assembly according to any of foregoing claims 43 - 45, c h a r a c t e r i z e d by means (9, 17) for treating said web (11) prior to the application of the particles by alum, polymer, electrolytic or corona discharge treatments.

47. Assembly according to any of foregoing claims 43 - 45, c h a r a c t e r i z e d by means (20) for augmenting the adherence of the particles of the web treatment material to the surface of said web (11) after the application step by electromagnetic radiation treatment using, e.g., infrared, ultraviolet, radioactive, x-ray or microwave radiation.

48. Method according to any of foregoing claims 43 - 45,

c h a r a c t e r i z e d by means (19) for augmenting the adherence of the particles of the web treatment material by mechanical or thermomechanical treatment.

49. Assembly according to claim 48, c h a r a c t e r - i z e d by at least one brush for elevating microfibrils (30) from the web surface.

50. Assembly according to claim 49, c h a r a c t e r - i z e d in that the brush material is selected so that the surface of the web (11) under a treatment with the brush material is charged with static electricity of negative or positive polarity as desired.

51. Method according to any of foregoing claims 43 - 45, c h a r a c t e r i z e d by a calender disposed after the particle treatment step downstream in the travel direction of the web (11).

52. Method according to claim 51, c h a r a c t e r - i z e d in that the distance between said calender (27, 28) and the application point (26) of said web coating material particles is selected so that the web can be calendered prior to the crystallization of the calcium carbonate particles from their amorphous state.

53. Method according to claim 52, c h a r a c t e r - i z e d in that at least one of the calender rolls (27, 28) is a hot roll.

54. Method according to claim 52, c h a r a c t e r - i z e d by means for treating said web (11) with a treatment material prior to calendering.

55. Paper, board or nonwoven product comprising a fiber layer containing cellulosic fiber, plant fiber or other material suitable for manufacturing a paper, board or

nonwoven product, c h a r a c t e r i z e d by having at least one surface of said fiber layer treated with elementary pigment particles of size in the range of 0.5 - 100 nm, most advantageously 15 - 25 nm.

56. Product according to claim 55, c h a r a c t e r - i z e d in that said particles contain at least calcium carbonate.

57. Product according to claim 55, c h a r a c t e r - i z e d in that said product contains particles of such an average size that they adhere to each other by van der Waals forces.

58. Product according to claim 55 or 56, c h a r a c - t e r i z e d in that said particles are also introduced between the web fibers, whereby the particles are bonded to the fibers by at least van der Waals forces and act so as to bond the fibers to each other.

59. Use of recycled calcium carbonate in the treatment of a paper, board or nonwoven product, said calcium carbonate being prepared by calcining the precipitated calcium carbonate residue of the deinking process of recycled fiber into lime, reacting the lime with water into calcium hydroxide and reacting the calcium hydroxide thus formed with carbon dioxide into calcium carbonate so that particles can be formed having an average particle size so small as to permit the particles to adhere to each other by van der Waals forces.